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Gas Journal

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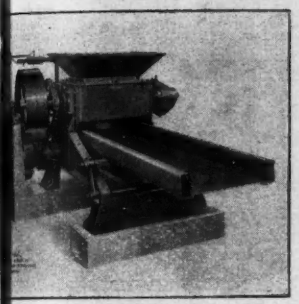

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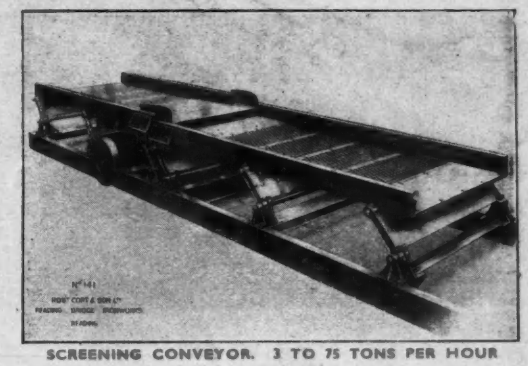

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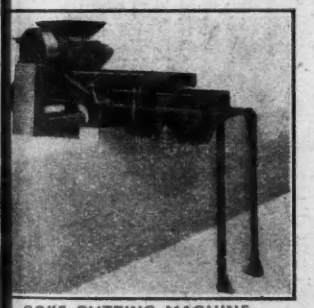

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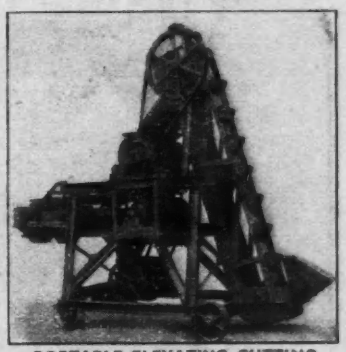

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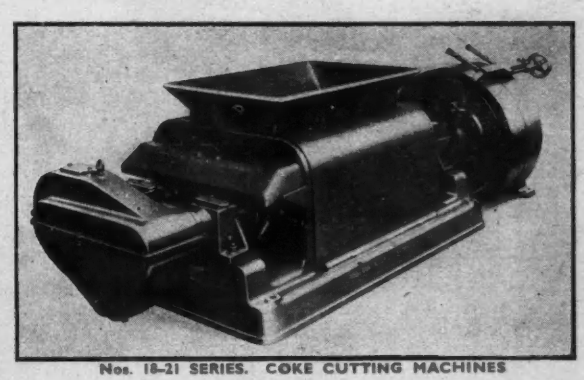

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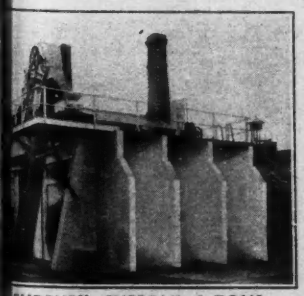

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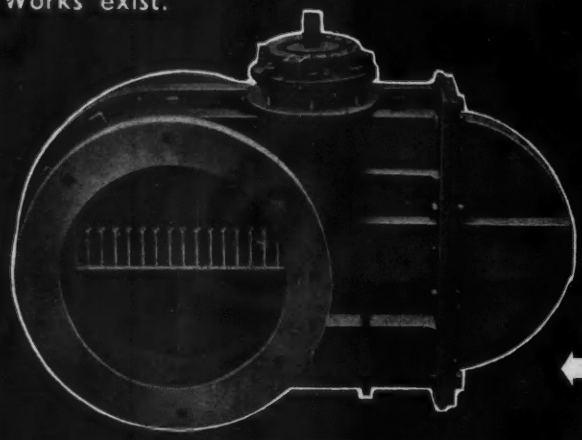

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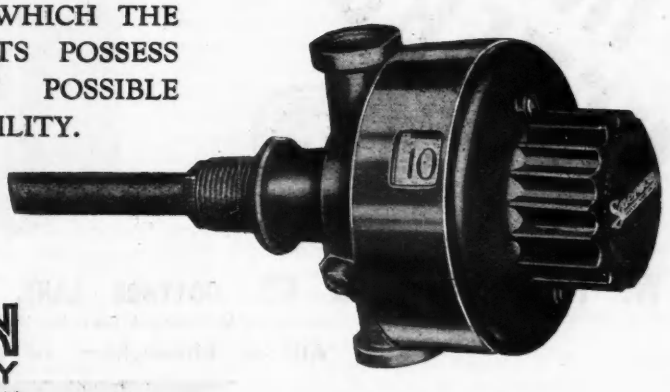

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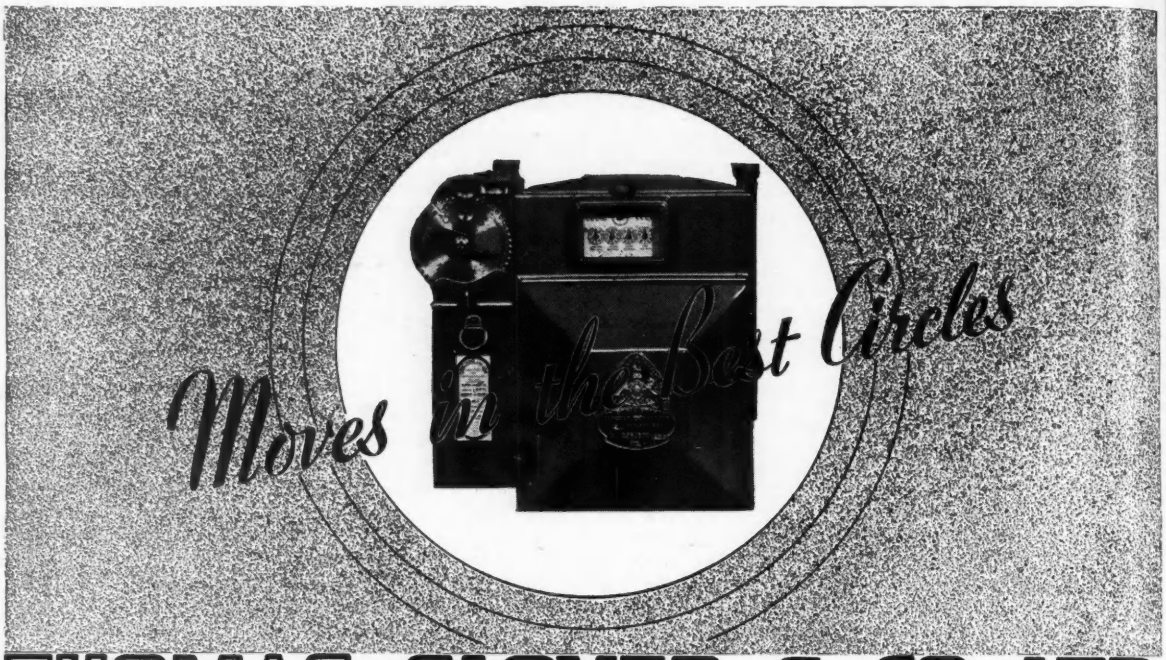

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GAS JOURNAL, AUG. 25, 1943

VOL. 242 95th YEAR No. 4188

EDITORIAL NOTES

SCIENTIFIC RESEARCH

THE recent lengthy debate in the House of Lords on the subject of scientific research was one of extraordinary interest, and symptomatic of current thought and feeling on the matter in responsible quarters. This most erudite and knowledgeable debate covered a very large amount of ground, and we can do no more than touch upon part of it here, and even so only sketchily. Perhaps, however, this note calling attention to it will serve as recommendation to study of Nos. 80 and 81 of Vol. 128 of Parliamentary Debates, which, at sixpence each, will prove an extremely good shillingsworth to all interested in or concerned with scientific research. Stimulated no doubt by the circumstances of war, both Houses of Parliament are taking an increasing and more serious interest in the subject—and we may remark *en passant* that four Ministers of the Crown have been trained in science and hold scientific degrees; perhaps this is a portent. No one urges that high scientific attainments are in themselves a qualification for administrative posts, but at all events they ought not to be regarded as a disqualification.

Opening the debate, Viscount Samuel called attention to the need for the further expansion of scientific research, particularly in relation to the utilization of coal. And he mentioned the formation and work of the Parliamentary and Scientific Committee, which now enjoys a membership from both Houses of 144, together with no fewer than 35 professional and technical associations, included in which is our own Institution. This development is again, we suggest, symptomatic. To what extent it has been spurred on by efforts in other countries we do not know, but it is salutary to look for a moment at what other countries are doing and how we stand in relation to them. Of course, we must beware of the comparisons—quantitative comparisons—which are so frequently made between what is done in the United Kingdom and what happens in the United States of America, in Russia, or, for that matter, in Germany. It is almost impossible to draw the line, for instance, between pure research and what we may term industrial development; and it is a fact that development is apt to cost enormously more than fundamental research. A slight error in delimitation, a small bias in assessing what is pure research and what is development, is apt to lead to totally wrong conclusions. We must take into account relative populations, and some may be inclined to agree with the view of Lord Cherwell that in the U.S.A., Russia, and Germany research expenditure is to an extent considered as an advertising point, and that therefore any endeavour to make a quantitative comparison is dangerous. After all, he said, "though the endeavour to discover the fundamental laws of nature should be regarded as an end in itself, to spend money on research is by no means an end in itself: it can only be justified if it is fertile, and to make sure that this is so is easier said than done." We are coming shortly to a few facts. There is no need for us to be in the least downhearted, but we should both be acquainted with and appreciate them. The history of British science in its many and varied fields is rich in the names of fundamental scientists of rare and true quality; many great names will occur at once to our readers. But does it help to produce a string of names of British scientists and then say, "There you are, the finest scientists in the world?" Science is international. The fact that we are at war does not alter this. We cannot usefully discuss scientists in terms of, say, a Test Match.

So let us have regard to a few facts which, it seems to us, will affect industrial relationships internationally post-war. It was brought out in the debate that industry itself in America—*i.e.*, industry, apart from various foundations and the universities with their million students—has no fewer than 2,200 research laboratories employing 70,000 scientists at a cost of some £60,000,000 a year. Of course, said Viscount Samuel, the definition "scientific research" is uncertain, and the line between research and development is not fixed; but it is probable that the expenditure on pure and applied scientific research for the benefit of industry and agriculture is in the United States, with three times our population, ten times the expenditure here. Nor is that all. Before the war both Germany and Russia had considerably larger provision under this head than we had ourselves. We know that it is not only the numbers employed in scientific research and the expenditure which is involved which are of ultimate importance; individual aptitude and successful results are of the first importance. One scientific genius may render greater service than a score or a hundred laboratories, no matter how lavishly endowed. And genius, or even initiative, cannot be commanded or easily evoked. At the same time, the more widespread and active the effort made by a nation in this regard, the more likelihood that genius and personal initiative will be revealed. And the fact remains that, *on the expenditure basis*, we occupy only the fourth place among the nations of the world.

Before turning to the aspect of the debate which interests us most directly—research on the utilization of coal—we would like just to mention a few of the comments of Lord McGowan on research in general. Describing research as reaching out into the unknown, he classified it as investigations to discover new products and new processes; research on existing processes with a view to finding new and simplified ways of manufacture and the discovery of better raw materials; and fundamental research. This seems to us a happy enough demarcation. And regarding fundamental research Lord McGowan considered this aspect as being far more a function of the scientific side of our universities, though he thought the Government research stations could do much useful work between the efforts of industry and the universities. Concerning comparisons with the activities of other countries, he urged that they should not lead us away into framing a policy which would result in the overcrowding of our universities with students of the wrong calibre. On the other hand, however fine our scientific effort may be in quality, we cannot disregard the size of the efforts elsewhere; again, it is useless having a sufficient number of scientists unless they possess the necessary equipment. Nor will the ablest and best types of men be attracted to the study of science if a system is allowed to exist in which the highest positions, including the best administrative posts, are closed to men with a technical education. Lord McGowan also referred to Government research associations—a system of research which "can no doubt play a large part in future development, but it needs to go a very long way before we can be in the least degree satisfied that it is up to the standard required by modern conditions."

We come to the particular—research on the utilization of coal—returning to the opening of the debate by Viscount Samuel.

§§

He recalled the findings of the Royal Commission on the Coal Industry of 1925–26, which quickly came to the conclusion—seventeen years ago—that the question of research was the most important of all. As is well known, the Commission recommended that the heat, light, and power requirements of the country should be considered as a whole. The recommendation was implemented last year by the establishment of the Ministry of Fuel and Power, and Viscount Samuel asked for some indication of the plans for co-ordination and the expansion of research into all branches of the fuel and power industries. Is there, he enquired, any plan for allocating the work between the three main agencies engaged in it—namely, the State, the universities, and the industries? And is there any prospect of a State scientific service being established parallel to the Civil Service? Obviously for the expansion of research on the lines envisaged, money would be needed; but there is no expenditure more remunerative than this if it is wisely directed. On coal alone the nation is spending about £360,000,000 a year in raw material, and as much again in processing and treatment for production of energy and for various chemical compounds. Altogether about £750,000,000 a year is spent on coal in one way or another. If research could improve overall utilization efficiency the saving that might be effected on the total expenditure on coal and processing of £750,000,000 a year would not be a question of one or two million pounds, but tens of millions of pounds. If that could be done, any programme of research, even though its cost might be regarded at the outset as extravagant, would be fully justified.

In 1920, as Viscount Falmouth pointed out, £75,000 was spent by industry in the research associations, which attracted a Government grant of £50,000. In 1937 industry subscribed £265,000, and that attracted a grant of £150,000 from the D.S.I.R. In his opinion twelve times the amount is spent in the laboratories of industry as compared with what is spent in the research associations. On this computation the total amount spent in this country on research is something like £7,000,000. It looks and is a large sum—but compare it with America's £70,000,000. Viscount Falmouth, of course, was Chairman of the Oil from Coal Committee which reported in 1938; in the debate under review he expressed the opinion that the question of coal as a fuel has been overstressed, and, he added—we badly need a Fischer Tropsch plant in this country, we badly need a Lurgi gas generating plant, and we badly need a full-scale plant for the carbonization of coal in hydrogen under pressure. He went on: How can we encourage the establishment of these plants? They are novel; they are expensive; they entail risks. Users are not particularly anxious to run risks—and "municipalities and public boards are not bodies which are prepared to take a risk. . . . They invariably play for safety first. . . . Public companies are somewhat more enterprising in this respect, but I am afraid that now, owing to financial stringencies, they are not able to undertake new developments as they used to in the past." Which argument led to the suggestion that a sum of, say, a million pounds might be given to the D.S.I.R. to last for ten years, and to be used as an insurance premium by which the risk of the new schemes would be carried by the State.

And this brings us to the Government reply, made by Lord Cherwell, who agreed wholeheartedly that to live on coal is to live on capital, which is precisely what we in Great Britain are doing. "Water power, of course, is income, but the energy we derive from it is barely one or two per cent. of what we get from coal; and depending as it does so largely upon the fortuitous configuration of the ground, there is little or no prospect of ever magnifying it to replace even one-quarter of the coal and oil at the rate we are consuming them." If we must live on capital, there is clearly every reason and argument for trying at any rate to make that capital last as long as possible; we should spare no pains to discover ways of using our coal economically—and the broad fact remains that something less than one-fifth of the stored energy of coal is converted into useful forms of heat and power. But, said Lord Cherwell, the Government is in fact doing something about it. The Fuel Research Station, B.C.U.R.A., and the Gas Research Board are spending £360,000 a year; more than half is found by the Government. We can anticipate expansion. He continued: "At least I can say this on behalf of the Government, that *if industry puts forward proposals for any sound scheme of expansion of industrial research it will find a sympathetic and generous response from the Government.*" The italics are ours. The Government, he said, recognizes that pure research must in large measure be Government responsibility; it is recognized, too, that in this matter, compared with certain other countries, we have not reached an adequate level of enlightenment. But steps are being taken. For example, an investigation has been in progress to make sure that the conditions of service, pay, and prospects of Government scientific employees compare favourably with those on the administrative side of Government, though "a man who is content to spend most of his working life pondering about the mathematical formula which expresses the relationship between the structure of atoms and the light they emit, about how a protein molecule is built up, or a nervous impulse is propagated, may well not be sought after as a boon companion at the bar."

It will be gathered that some of the questions asked in the debate were left unanswered. From our brief and sketchy notes it will be gathered too, we think, that, taking Lord Cherwell's reply, the Government is ready enough to listen to reasonable claims and to assist financially—*i.e.*, through the taxpayer—promising enterprises in the field of fuel utilization starting from coal. And it is a healthy feature, when we think of broad fuel policy and the best use of coal, that Gas Industry research should figure clearly, and that the potentialities in the national interest of expansion of this research should be appreciated in responsible Government quarters.

HALT! WHAT GOES ON?

A FORTNIGHT ago we "came by" the information that the so-called "fact finding" Committee of the British Gas Federation had completed its investigations. We advisedly use the expression "came by" because, as we have so frequently remarked in the past, information never exactly flows out of Gas Industry House in a torrent. In fact, not so long ago we made ourselves decidedly unpopular at Headquarters by referring to the "veil of secrecy" which appeared to cover certain deliberations known to be in progress at the time, and we must confess that on the present occasion, too, our disclosure of the fact that the Sylvester Committee had done its work was received with anything but acclamation. As, however, we had not seen (nor desired prematurely to see) the Committee's report, and as our comment was merely upon information which was open to everybody, we are entirely unrepentant.

An unusual sequel is that a correspondent, who coyly signs himself "One of the Democrats," has used our article, and a number of direct quotations from it, as the text of a long letter to the *Gas World* (without asking us to publish a copy of it), and from this letter and other disturbing manifestations up and down the land our contemporary concludes that there is a rift in the P.W.P. lute. We would say rather that, throughout the piece, riftless lutes have been a comparative rarity in the P.W.P. orchestra. The trouble is that each section thinks it is playing in tune while it can hear nothing but discords from the rest of the performers. Unfortunately the *chef d'orchestre*, in the shape of the co-ordinating committee, has quite failed to get them to blow in harmony, because they all seem to agree that he is the rottenest of all.

We cannot quite make out whether "One of the Democrats" is cross with us or not, which is a pity, because we so heartily agree with much that he writes. In fact, we almost recognize in his letter to the *Gas World* bits and pieces from other Editorials of ours besides the recent one which he does us the honour of quoting. But, without holding a brief for Gas Industry House in so far as it indulges in "hush" not absolutely necessary for reasons of policy which may be known to it alone, we do not think that any Democrat has legitimate cause for grievance that such writings as were referred to in our article should be made

upon walls in London. After all, they could hardly be scribbled on hoardings up and down the country like the familiar incentives to open second fronts at all kinds of unpropitious moments. But we do heartily agree with him that such findings must be available for all to see, and we have never had any idea but that they would be. We assure him that he is not being "denied a privilege which has apparently been accorded to the Press"; as we stated above, we have not seen a copy of the report. Yet we cannot resist asking once again whether there could be any more direct and simple method of disseminating information to the Industry *than* by means of its Press; yet does Headquarters *ever* make use of the Press which is at its disposal? And why, pray, should Democrat refer to us rather grudgingly as "better informed"; would he, or an autocrat for the matter of that, ever buy a newspaper except in hopes of reading in it something he did not already know?

Unfortunately, for whatever reasons (and we do not propose at this stage to undertake the rift-widening job of discussing them in detail yet again), the Industry is still a long stride from agreement. Many months ago we ventured, while freely acknowledging the difficulty of the matter in hand, to point out to Headquarters that their methods were disliked, and to the Districts that only constructive criticism was of any value in the circumstances. We commented, too, upon the lamentable lack of influence which the ownership of gas undertakings exercised on the situation, largely through letting it go by default. And now there is a flurry on the part of ownership on all sides, which we think is an excellent thing. Good luck to the movement, and may it bring strength to the cause even at this late hour. And late it is, because we are convinced that appeals by individuals, districts, or anybody else to the B.G.F. or to the P.W.P. Committee for "more time" cannot be of much avail at this stage. The demand for conclusions by a certain date is from "higher up."

Electricity Supply Proposals

A recommendation that the electricity supply industry should be brought under unified public control is made in a report just published by the Electrical Power Engineers' Association, a body representing the technical staffs in the industry. The report was drawn up by a sub-committee appointed by the Association to consider post-war planning as affecting the electricity supply industry. The national council, in expressing approval of the report as amended, asks that the Government should, without delay, provide by legislation for the appointment of a National Electricity Supply Board, which would have power to acquire all statutory electricity undertakings in the country, and would be responsible for national control and policy relating to the generation, transmission, and distribution of electricity as a public service. The reforms proposed, it is argued in the report, would do away with the present lack of uniformity in tariffs and services, and make possible an adequate supply to all parts of the country. The authority to be empowered to acquire the undertakings should be, not the State, but a statutory board appointed by the appropriate Minister.

This board, it is suggested, should be composed of members with technical, commercial, or administrative abilities and experience in the electricity supply industry, together with members representing interests vitally concerned in the industry, including employees engaged in it. The terms of acquisition of statutory undertakings by the board should, unless otherwise agreed, be on the basis of payment of the fair value (*i.e.*, capital cost, less depreciation) of the physical assets. The country should be divided into distribution regions determined by the Electricity Commissioners—who should be retained, though their powers and duties might require to be reviewed in the light of changed conditions—and each would be under the control of a regional distribution engineer and manager appointed by the National Electricity Supply Board. The interests of all classes of consumers would be safeguarded by regional consultative committees, which would have a right of appeal to the Board and to the Electricity Commissioners. The board, it is proposed, should take over the Electrical Development Association and should be responsible for electrical development; and one of its tasks should be to devise a suitable system of tariffs and to ensure the adoption of the system throughout the country.

Personal

Mr. J. R. BRADSHAW, General Manager, Secretary, and Director of the Hartlepool Gas and Water Company, has been appointed a Justice of the Peace for the County Borough of West Hartlepool.

* * *

Dunfermline Town Council has offered the post of Gas Engineer and Manager to Mr. E. G. SMITH, who for several years has been Gas Manager at Dumbarton.

* * *

Mr. STANLEY DIXON, M.A., A.C.A., who has been the Secretary of the Midland Tar Distillers, Ltd., for the past eight years, has been appointed to a seat on the Board in place of the late Mr. Herbert Bairstow.

* * *

Major S. O. PACEY has returned from the Middle East and is reassuming his duties as Engineer and Manager at the East Retford Corporation Gas Department.

* * *

The Directors of the Isle of Thanet Gas Light and Coke Company have presented a cheque to Mr. A. J. STICKELS, Secretary and General Manager, who has completed 52 years in their service. Mr. Stickels entered the Company's service as a Junior Clerk in August, 1891, became Secretary in January, 1914, and reached his present position in 1940.

* * *

Mr. HAROLD MILLNER, Works Superintendent to the Scarborough Gas Company, has been appointed Assistant Engineer and Manager to the Company. Mr. Millner holds a First-class Honours Degree, B.Sc.(Leeds), in Fuel and Gas Engineering, and was awarded the Le Blanc Medal in the Honours Class of Applied Chemistry.

* * *

Mr. W. A. WOOSNAM, at present Works Foreman at Tyldesley, has been appointed Superintendent Gas-Works Foreman to the Milford Haven Urban District Council. He has held similar positions at Malton, East Hull, and Exmouth, and was trained at Wallasey.

* * *

Miss ANNIE ROPER, of Leeds, has completed 60 years' service with Messrs. George Bray & Co., Ltd., and the occasion was marked last week by the presentation of a cheque by Colonel Bray, the Chairman of the firm. Miss Roper, now over 70 years of age, carries on with her work energetically, cheerfully, and efficiently.

Obituary

Mr. JAMES REGINALD LANE died suddenly on Aug. 9, at the age of 56. Mr. Lane, who had given much of his time to voluntarily assisting the Government in the war effort, was actively associated for many years with the heavy chemical and tar industry, where he will be greatly missed for his cheerful disposition and generous nature. He was a Director and Chairman of Lancashire Tar Distillers, Ltd., and a number of other companies, including the National Benzole Co., Ltd. He was President of the Association of Tar Distillers in 1934 and 1935, and sat on several committees connected with the trade, including the British Road Tar Association, National Creosote Committee, Association of Tar Distillers' Executive Committee, Coal Tar Controller's Advisory Committee and National Road Tar Committee.

* * *

Messrs. Thomas Potterton (Heating Engineers), Ltd., have suffered a great loss by the death of Mr. FREDERICK BROOKS, which occurred on Friday last at the age of 58. He is survived by a widow and two sons. The elder son, Mr. E. G. Brooks, is Assistant Manager of the firm, and the second son, the Rev. Reginald T. Brooks, B.A., B.Com., is Pastor at Skipton.

Mr. T. F. C. Potterton writes:

The death of our dear friend and colleague Frederick Brooks, following the passing of his elder brother F. G. Brooks last autumn, deprives the Industry in general and my firm in particular of the second of two able men who in their respective spheres made most valuable contributions to the development and success of the application of gas to the many problems relating to water heating. I should like to pay tribute through your columns to his memory, which desire is shared by my co-directors, the whole of the staff at Cavendish Works, as well as his large circle of friends, from whom at this early moment I have already received messages of sympathy and deep regret.

During an association of fully 40 years Fred Brooks proved to be a loyal friend and companion in business and social circles alike, and we are all poorer by his absence from our midst.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Letter to the Editor

"Carbonizing Plant Problems"

DEAR SIR,—I was interested in the Paper "Carbonizing Plant Problems," and through you would like to thank the Author for a valuable contribution. He made many useful comments, one of which suggested that horizontal retort practice had not had that "follow up" by contractors as is the case with verticals. With this I agree, and the consequence is that the virtues of horizontals are less voiced than those of verticals.

It is generally recognized that higher thermal yields of straight coal gas per ton of coal can be obtained by horizontals than with verticals. Why? Perhaps the answer is that, provided a free space is left over the charge—

(1) Pressure control can be exercised in a horizontal retort.

(2) It is a tighter retort due to the absence of steaming.

(3) Secondary cracking of the tar vapours can take place in the free space over the charge.

(4) In a vertical retort two operations are taking place simultaneously—*i.e.*, carbonization and water gas production, and a compromise in working has to be struck.

(5) Pressure control is confined to the top of the retort above the charge.

(6) The temperature of the space where the coal enters the retort is relatively low, and secondary cracking is probably negligible.

It would appear that horizontal practice is not without its attractions, and for best results I suggest there is a critical weight of charge to suit the dimensions and the temperature of the retort.

"OBSERVER."

Aug. 15, 1943.

Diary

Sept. 16.—Association of Gas Corporations: Council, 3.30 p.m., Gas Industry House.

Sept. 20.—London and Counties Coke Association: Finance Committee, 10.30 a.m.; Executive Committee, 11 a.m.; Central Committee, 12 noon; Annual Luncheon, 1 p.m.; Annual Meeting, 2.45 p.m., at the Waldorf Hotel, Aldwych, W.C. 2.

Oct. 11.—National Federation of Gas Coke Associations: General Committee (Special Meeting), 2.30 p.m., Gas Industry House.

Oct. 12.—National Federation of Gas Coke Associations: General Committee, 10 a.m., Gas Industry House.

An Up-to-Date Canteen

The Mayor and Mayoress of Twickenham recently opened, for Messrs. Hall & Hall, Ltd., of Hampton, Middlesex, the last word in works canteens. With seating accommodation for 360, to be increased later to 500, dinners, teas, and night shift meals are supplied. Air conditioning and softened water are outstanding features. Trolley service and a 28 ft. sweep of hot and cold service counters make for speed. Hot water temperature is thermostatically controlled. The equipment supplied by Radiation Ltd. to the order of the Hampton Court Gas Company is as follows: 3 "Chester" gas ovens on stands; 2 boiling tables; 2 25-gall. vegetable boilers; 2 NK.2 steamers; 1 2-pan fish fryer; 1 salamander and griller; 1 stockpot stand; potato peeler; potato chipper; refrigerator; range of wooden and earthenware sinks for vegetable preparation.

Society of British Gas Industries

Prizes in connexion with the examinations of the City and Guilds of London Institute in Gas Subjects have been awarded by the Council of the Society of British Gas Industries as follows: Minor Course in Gas Supply Practice—1st prize (£5 5s.), W. D. Cock, Torquay; 2nd prize (£2 2s.), L. E. Doel, Abergavenny. Final Examination in Gas Fitting—1st prize (£5 5s.), J. L. Foster, student of L.C.C., Westminster Technical Institute; 2nd prize (£2 2s.), equally between A. D. T. Voice, Cheltenham, and E. J. W. Smith, student of L.C.C., Westminster Technical Institute.

Mr. George H. Boucher, Chairman of the Bristol Gas Company, at a recent meeting of Directors presented long service certificates to nine employees who have been pensioned during the year. At the present time the Company has 120 pensioners, whose average age is 73, and their average service with the Company 38½ years. One employee, who retired after 49 years, had not lost a single day through sickness, while another who had 45 years' service had only lost four days through sickness. The war record to date of the male staff of the Company's showrooms is interesting. Of the nine enlisted, six are serving overseas. One is a Major, recently awarded the M.C., and five are Lieutenants. One, a Flight Sergeant, is a prisoner of war; the remaining two are older members and were only recruited within the last twelve months.

A Rural "Gas-Works" of 1943

Our photograph is an interior view of a village gas-works on modern lines. This up-to-date works is on the line of the high-pressure main of the West Yorkshire Gas Grid, an account of which was given in the "JOURNAL" last week. Taking gas from the main at a pressure of 30 lb. per sq.in., this station in the heart of the country governs down and distributes an ample supply at constant pressure over the rural area supplied—and the gas, of constant quality, is very low in sulphur. The villager, as we said last week, is now enjoying a type of gas service hitherto unknown to him; and the "gas-works" would serve as good interest and propaganda value if it could be housed in a glass case along the main street, a silent witness to what lies beyond gas service.

SUBMERGED COMBUSTION*

By F. E. LANE,

Industrial Gas Engineer, United Kingdom Gas Corporation, Ltd.

WHEN asked to present a short Paper before this Association it occurred to me that the members would be interested in a new development which has recently arrived in this country from the United States of America.

I refer now to true submerged combustion, which, although little known in this country, is rapidly extending its use in the United States of America and is a development which was first considered in 1887. Approximately twelve years ago experiments were started in America to perfect a burner which would be practical for use in sulphuric acid pickling tanks and which could be automatically ignited and controlled. It was decided to conduct all the test work on this burner in an acid pickling department in order to find out whether the equipment could withstand the corrosive atmosphere and rough treatment associated with this class of work.

The results obtained with the first experimental burner were outstanding, and, from this point, work was directed to the simplification and improvement of layout and design. It was not, however, placed on the market until about the year 1937, as the inventors of this system were most anxious to be absolutely certain that the apparatus was foolproof and also a commercial proposition.

The submerged combustion system consists of a control assembly so designed that the operator has only to depress a starting button to put the entire unit into operation. When the starting button is depressed, gas and air compressors are started up and deliver the mixture at such a pressure that the products of combustion can overcome the head of liquid in the tank. The burner and the combustion chamber are located beneath the solution level, which ensures cooling by the surrounding liquid. The burner is of the nozzle mixing type with no possibility of back-firing, and the combustion chamber is of tubular design which conducts the heat and products of combustion down to and across the bottom of the tank, from where they are vented into the solution and distributed, rising in the form of bubbles to the surface of the solution.

To explain in detail the operation of this apparatus, the procedure is as follows:

(1) The button is pressed which starts the gas and air compressors.

(2) Air is supplied from the compressor which forces or purges the liquid from the burner and combustion chamber.

(3) Automatically a hot-wire igniter is heated to incandescence by the passage of a current of high density at low voltage.

(4) After a predetermined time a flow of pilot gas is admitted to the burner, where it is ignited.

(5) The main gas is, after a short period, allowed to enter the burner, where it is ignited by the pilot flame.

(6) Following the ignition of the main gas the burner controls lock themselves into a running position until the desired temperature is attained.

(7) The thermostat then operates to control the gas flow and regulate the heat input according to production demands.

(8) In the event of complete shutdown of the thermostat, the control mechanism is so designed that the air continues to flow through the burner and combustion chamber, and maintains a fixed rate of agitation which is so desirable for the "pickling" process.

(9) When there is a demand for heat the thermostat re-cycles automatically the controls and the operation commences at No. 3.

Application

As this system was first developed in a steel mill in America, it has been applied chiefly for the heating of pickling tanks, vats, or tubs, as they are usually termed in the U.S.A., and the information I have available at the moment is concerning this particular process. "Pickling" in the steel and wire industry is a process of de-scaling, or the removal of scale from steel after being heated and drawn in the rolling mills. Generally the steel is immersed in a live steam heated tank or vat, containing approximately 5% to 10% sulphuric acid at a temperature varying between 180°F to 200°F. The action of the hot solution removes the scale from the steel, but the process is rather a slow one, and in order to increase the output it is necessary to install mechanical means of agitation or add chemical acceleration to the solution.

There are many disadvantages associated with this method, which, to my knowledge, is the only method used in this country at the present time:

(1) The steam injected into the solution condenses, thus gradually increasing the working level of the solution to a point where it is necessary to drain off a part of the bath to maintain the proper working level. Obviously a certain amount of acid is lost, and concentrated acid must be added to the tank to bring it up to the required strength.

(2) There is also the difficulty in disposing of this drainage, chiefly because of stream pollution Acts, &c. In the majority of cases the spent acid must be taken away to a pit, or the iron must be settled out and the acid neutralized before allowing the effluent to enter the sewers.

(3) As mentioned previously, steam heated tanks are usually operated at temperatures between 180–200°F., and at these temperatures acid fumes are not only present round the tanks but often carried to adjacent shops, with resultant complaints from the workmen; in addition, there is a rapid deterioration of the handling equipment and building structures.

With submerged combustion burners the above disadvantages are almost eliminated. In the first place, the products of combustion are exhausted directly into the solution, generally dilute sulphuric acid, thereby creating a terrific agitation, moving the solution about the tank at a rate which would be extremely difficult to achieve mechanically. As a result, the average pickling time on various grades of steel is reduced to between 40 to 70% of former practice if the operating temperature is held the same as it was with steam, and in addition the agitation also serves to keep the temperature extremely uniform throughout practically any size of tank. There is no dilution of acid as in the use of steam. In fact, the direct firing evaporates water and tends to concentrate the solution, so that a small amount of water must be added to maintain the working level of the tank.

The powerful agitation causes a scrubbing action on the chemically loosened scale, thus creating a further saving in acid which may total 25 to 50% of the acid added after the original bath is made up.

The operating temperature of steam heated "pickling" tanks is between 180° to 200°F., and I think the only reason why plants are operated at these temperatures is because it is the only way they know to obtain the output necessary to keep their machines supplied. It is claimed that the tonnage obtained from a still tank heated with steam to 190°F. can be equalled by submerged combustion at 160°F. The benefits in reduced heating costs and operating conditions from this lower temperature are obvious, and I would like to point out that the surface heat loss at a temperature of 190°F. is almost twice that at 160°F. It is therefore easy to understand that in general the trend for pickling temperatures has been downward in recent years in the United States of America, and this undoubtedly has been caused by the extended use of submerged combustion.

To give some indication of excessive operating costs due to high temperature in the "pickling" process it would be as well to quote a case, particulars of which have been sent to me from America.

In this case the pickling department for a wire mill was inadequate and steam was the heating medium. To fill the "bake oven" of this mill with a sufficient number of rods to keep the rod blocks supplied with pickled, limed, and dried rods, a pickling cycle of 12 to 15 minutes had to be maintained. As there were only four two-pin pickle vats, a temperature of around 190°–195°F. and an acidity of 5–7% were necessary. If two more pickled vats had been added to the pickling department and the proper use of a good accelerator incorporated in the practice, operating temperatures could have been reduced to 155°–160°F. and the pickling cycle increased to 20/25 minutes. The net result of this added capacity and the consequent change and improvement in practice would be a saving of approximately 10 lb. of acid per ton of rods pickled.

Perhaps one may ask would the expenditure for additional equipment be justified? A brief consideration of the following data will prove conclusively that such added equipment would prove economical. The production of pickled rods required in the mill under consideration is about 6,000 tons per month; assuming the cost of acid is about £3 per ton, the net monthly saving effected by the additional equipment and the improved practice would be about £90 per month. There are also more intangible savings—*viz.*, added life of the equipment, reduction in steam losses, and the improved operating conditions would also contribute to these savings.

Using submerged combustion, however, the conclusion would be quite different. Equip the existing four acid tanks with submerged combustion burners. Drop the working temperature to the same level—*viz.*, 155°–160°F.—and maintain the original time cycle of 15 minutes. Due to the effect of direct firing the acid saving would be the original 10 lb. per ton, plus approximately 40% of acid added during the life of the solution. Added to the intangible savings, there would be no steam loss, as no steam would be required.

To cite another example and in order to indicate clearly the advantages of submerged combustion as against steam the following figures are given: In a particular plant there are two wire coil tanks, one holding two pins and the other holding five pins of coils. During a three-year period open steam jets were used to heat the solution, and during that period the average pounds per man-hour was 1916.

The following year the two-pin tank was fitted with a submerged combustion burner, and this burner operated, on an average, 50% of the time over a four-year period. The pounds per man-hour rose

* From a Paper to the Manchester and District Junior Gas Association.

from 1916 to 3,129.9. The following year the burner was kept running every production day of the year and the pounds per man-hour went up from 3,129.9 to 4,022.8, an increase of 209.9% over the three-year period when steam was solely the heating medium.

The next year the larger tank was fitted with submerged combustion, but the rise was smaller due to the inability of the men and auxiliary equipment to handle the steel. The figure rose, however, to 4287.2.

Bar Pickling

Prior to using submerged combustion, the bar tanks in the same works were operated at a temperature of 190°F. and the pounds for man-hour averaged 5,650. When submerged combustion burners were installed the operating temperature was lowered to 160°F., yet the pounds per man-hour rose to an average of 7,926.6 for the two years the burner has been in operation. This is an increase of 40.3% after lowering the solution temperature from 190°–160°F., and all other intangible benefits were obtained as previously mentioned, such as no dilution of acid with the consequent savings, &c.

It is only natural that the generation of heat, right in the solution or liquid, should result in decreased heating costs. As the heat for each tank is generated in that tank, this means complete independence of a central boiler, the efficiency of which falls off at anything under full load rating.

In many plants the boiler is run in the summer time only for the "pickling" department. Submerged combustion burners fitted to tanks allow the boiler house to be shut down completely during warm weather, which will effect even greater savings in heating costs. In fact, it is possible in some instances to discontinue operating a large steam boiler entirely, and to heat the building with any of the direct gas-fired heaters now available.

I have mainly referred to submerged combustion burners as applied to sulphuric acid pickling tanks, but there are other applications to which this system of heating can be used. It is especially adaptable to the rapid distillation and concentration of liquids. It may be used to heat and agitate many types of cleaning solutions. It is also being used to de-scale steel plates and structural shapes for the United States Government in their Naval shipbuilding yards, and is proving a huge success, so much so that several additional sets of equipment are being installed.

Efficiency

Obviously the combustion efficiency of submerged combustion is high, and the following figures give an indication of this.

The efficiency on the burner is about 96% at an operating temperature of 140°F. At 160°F. the efficiency drops down to 88%; at 175°F. to about 84%. The practical high temperature for operating submerged combustion equipment is 175°F. The theoretical maximum is 192°F.

Burners can be supplied in single or double units. A single burner unit consists of gas and air compressors, burner, and the necessary apparatus for ignition and control. Rated capacity of the single burner units ranges from 250,000 to 1,800,000 B.Th.U. per hour. In a double unit, two burners are connected to the one set of compressors, the controls remaining essentially the same except that provision is made for additional ignition current, and the gas and air controls arranged so that these flows can be adjusted for each burner.

The comparative costs of gas as against steam are indicated by the ollowing authentic figures obtained on one plant over a year's operation:

The steam cost averaged on a complete year's operation the sum of 45 cents per ton as compared with 13 cents with natural gas at 75 cents per 1,000 cu.ft. In the same periods, acid consumption dropped from 23.1 to 18.4 per ton, a reduction in cost of 4.7 cents per ton, or about 20%. In this particular case the pickling bath temperature was brought down from 185°F. (with steam heating) to 155°F. with submerged combustion, along with an increased pickling speed of 20%.

By arrangement with the Submerged Combustion Company of America my Corporation is about to install two sets of submerged combustion equipment in a steel works in this country, and providing no objections are raised by the firm concerned it may be possible at a later date to give particulars of the results achieved, which I feel sure will be comparable with those obtained in the U.S.A.

The two tanks in which the submerged combustion equipment is to be fitted are 43 ft. long by 4 ft. wide by 4 ft. deep, and the annual gas consumption, based on a 140-hour week, is estimated at 22 million cu.ft. In addition hot neutralizing and hot rinse tanks are to be fitted with gas-fired immersion burners, which will make the estimated annual gas consumption for this installation approximately 35 million cu.ft.

There is no doubt that there is a great future for submerged combustion.

THE DESIGN AND PERFORMANCE OF GAS WORKS PLANT

By A. G. GRANT, M.Sc., M.I.Chem.E., Assoc.M.Inst.Gas E.
General Manager, The Whessoe Foundry and Engineering Company Limited

Institution of Gas Engineers, June 9.

DISCUSSION

Mr. C. Cooper (Messrs. W. C. Holmes & Co., Ltd.): A Paper such as is presented by Mr. Grant will necessarily read somewhat pessimistically, seeing that, if the more satisfactory conditions for which he is asking existed, the Paper would not need to be written. Conversely, if the commentator finds himself unable to agree with the Author, he is likely to err on the side of complacency. With due regard for this danger, I do not feel that the position is quite as bad as Mr. Grant seems to suggest. Mr. Grant admits, it is true, a considerable advance during the past 20 years in the direction of designing chemical engineering plant for gas-works on more fundamental principles than before that time, and there is no reason to believe that these tendencies are not fully appreciated by the purchaser in the Industry, or that the purchaser will become increasingly critical of equipment offered him. I entirely agree, incidentally, with the remark that advances which have taken place are frequently unrewarded owing to the prevalence of imitation.

Technical advances may, however, take the form of standardization in recognized units, which may result in its being possible for any manufacturer, capable of doing a job of average quality, to meet the requirements. In fact, it might be contended that tailor-made contracting for each and every job will progressively decline for units of ordinary gas-works construction, though it will have to continue in application to more complex and to newer processes.

Having said all this, I will now go so far as to state that the most interesting, and sometimes most difficult part, of a technical contractor's correspondence may consist to-day in answering queries from the operators of plants who have sufficient appreciation of the principles involved to make the asking of questions and the answering of them a more responsible job. It is often more possible to answer a question on a technical subject with precision than a discussion of £.s.d.

I would share with you a vision of a time when your typewriter will have a Greek alphabet and will be fitted with arithmetical signs and integrals in place of some of the more conventional keys, and letters may be written on it to fix a contract without an £.s.d. sum being mentioned. I may have to live a long time to write such a letter, but I am willing to wait as long as it is necessary.

Another point on which I think one might join issue with Mr. Grant is his suggestion of the reluctance of a contractor to publish technical information. I think that this should be qualified by observation of the growing proportion of Papers furnished by contractors who are in such competitive work, and I would also mention the considerable numbers of Papers by research staffs of gas undertakings, as well as of public bodies, including The Institution of Gas Engineers and others. This tendency will, I feel sure, increase in the future in spite of the danger which is always present of creating competition where none previously existed.

These changed tendencies exist not only on the contracting side, but on the operating side of the Industry, and as the present younger generation of gas engineers receives its due promotion, the tendency should spread further over the Industry. It is perhaps not to be expected that the smallest of works will be able to call on specialized skill equal to that available to the larger undertakings; nevertheless the general influence will be felt, and this will result to the benefit of all engaged.

Mr. R. J. Restall (Stalybridge): In his Paper the Author presents forcibly two pictures—one the way in which the Industry should move as to design and performance of gas-works plant, the other the failings of gas engineers. There is much in the first picture with which I feel we can all agree, especially in that the design of gas-works plant should be approached from the scientific side, incorporating sound engineering principles, and remembering that the plant used by us needs to be of sound, robust construction. This latter requirement is partly responsible—a point which the Author appears to have overlooked—for our apparent inability to keep pace with improvements in methods and processes. In particular this may be true, but I cannot conceive that such a state is general. It is not possible for even the wealthiest undertaking—neither is it prudent—to scrap useful plant for the sake of intermediate improvements. The normal gas-works plant is put down with the idea of securing a life from 15 to 20 years. Although it may be, and it is my experience that it has been possible to make minor improvements, the plant must be allowed its life, unless it turns out to be a fundamental failure.

The Author places considerable stress on the chemical engineering aspect of our Industry. The work of the gas engineer is not chemical

engineering but gas engineering, and over a long number of years we have built up a considerable technique of our own, in particular as regards temperature.

The Paper prompts me to put the point that in the approach to post-war problems the matter of obtaining the correct size of manufacturing unit for particular conditions should be scientifically explored.

The other picture which the Author presents, regarding the relations between the two sides of the Industry, seems to be very wide of the true facts. The Author's experiences must have been singularly unfortunate. One recalls many instances in which a progressive contractor has had to thank a bold and foresighted engineer, and it is suggested that unless these two had been brought together in the past, our progress would not have been so marked. Further, there are many individual thinkers who have added much to our Industry.

I can assure the Author that we do take a critical interest not only in performance, but in the construction of our plant, and the contractor who secures an order and does not follow up with service is doing a great harm to his side of the Industry. The gas-works with which I have been associated have always accepted the principle of collaboration with contractors, and there appears to me to be somewhat of an indictment in many of the Author's remarks.

In the design of its requirements, the Admiralty uses a design pool and has thus the privilege of incorporating in any project numerous improvements from whatever source, and the Author's complaint on the lack of information on design and fundamentals could be overcome by adopting such a plan.

In the matter of competition, the problem appears to me to be one of the issue by the gas engineer of a carefully correct specification, giving no loopholes for infringement, but even this could be defeated by the adoption by a contractor of the principle of taking a lower profit for the specific purpose of demonstrating the value of a new type of plant, for instance, or working on a lower margin.

To all intents and purposes I am in complete disagreement with the spirit of the second picture presented by the Author, but recognize that a better understanding between us will lead to higher standards and better working results. I suggest, however, that in the past we have been most appreciative of our gas engineering contractors' efforts.

Dr. **J. G. King** (Director, Gas Research Board): Perhaps the outstanding note in Mr. Grant's Paper is his recommendation to all gas engineers to study scientifically the operation of their plants by dissecting each stage of the process separately. A good overall performance figure, of course, is always desirable, but it gives no insight into the process itself. How much more satisfactory is it to consider each step separately, compare this performance with calculated theoretical efficiency, and decide where best to expend energy in attempting improvements. Mr. Grant gives several interesting examples wherein such studies have indicated weaknesses, and have finally led to improved designs of integral plant which, if adopted generally by contractors, would help others perhaps less fortunately placed as regards facilities for experiment. It may be argued that this is only a short-term policy, but in the expansion which it is hoped will follow the war there will be an increasing need for new designs of plant and new distribution systems, which will call for all the scientific experience which can be gained from existing methods and training. Engineers after the war may be faced with the task of designing plant with only a few indications of the changes which may be imminent in such important factors as coal cost, labour charges, and commodity demand. It follows that they must prepare themselves to be in a position to design plant which will be sufficiently flexible to deal efficiently with all the variations which may arise.

The need for such additional scientific thought means what Mr. Grant asks for—more chemical engineering in the Industry. In this country we are definitely behind the United States, and in this Industry behind the oil industry, in this branch of engineering. We must have more schools, and the Industry must offer attractive posts to young men to take advantage of such training as these schools will provide.

It is interesting to observe that the D.S.I.R. is now looking into the question of the training of fuel technologists. The Gas Industry should do the same for its future scientific personnel.

Finally, I cannot refrain from taking advantage of an observation which Mr. Grant has made regarding the Gas Research Board. He says that the main work of the Board is the conducting and co-ordinating of the fundamental research of the Industry. The Board will attain this high objective only with the collaboration of all the technicians in the Industry. The scientific staff of the Board will do their job more efficiently if they have the collaboration of all the technicians throughout the country, and I make this appeal to them now to take a real interest in the work of the Board, to offer suggestions for research work, and to comment freely on existing lines of research.

INSTITUTION DISCUSSION

WRITTEN CONTRIBUTIONS ON COMMUNICATION No. 259

STANDARDS OF TECHNICAL PERFORMANCE

By G. DIXON

Mr. **A. J. Leather** (Blackburn) wrote: I should like to refer to Mr. Dixon's Paper in so far as it relates to the calorific value of the gas, but before making detailed comment may I refer to the first sentence in Mr. White's Paper, in which he states, "Whatever may be the nature of the work of research and development undertaken by the Gas Industry, it must be judged by the resulting benefits, direct or indirect, to the consumer"? It would appear that this valuable precept is not always in the forefront, especially when dealing with gas quality. The Report on Gas Quality seems to indicate that generally undertakings are not prepared to make any radical alteration in the present declared value and that local interests are coming before national interests, thereby hindering the attainment of the most desirable standard for the community at large.

Mr. Dixon, in his Paper, appears to support the *status quo* by underlining that part of the Committee of Enquiry's Report recommending freedom of choice in calorific value. In other words, leave things as they are providing the "quality" in any given undertaking does not vary more than $\pm$ 5 per cent.

A formula is also put forward for the purpose of comparing the performance of gas making in different types of plant. The main effect of applying this formula is to make a paper increase in the efficiency of gas production, thereby giving a comfortable feeling regarding present methods of manufacture, and favouring the present range of higher calorific values in preference to a lower grade of gas. An output of 75 therms of gas from 300 therms of coal, being an efficiency of 25 per cent., is converted to a production of 167 therms, or an efficiency of 55.7 per cent. The statement is both erroneous and misleading, and the "unearned increment" of 92 therms should certainly not appear on the credit side of any thermal balance-sheet. The term "standard ton of coal" is likely to lead to misunderstanding and it is not mentioned in the original report presented by Clerk, Cobb and Smithells, which was an attempt to compare the relative efficiencies of gas and electricity in generation and use. A "standard quantity" is generally accepted as meaning one of unvarying value against which other values may be compared, but the "standard ton" now devised has no such stability and varies with every proposition that is considered. In other words, the performance figure suggested is simply a method of stating the gas "make" per ton of coal after a deduction for residuals, a perpetuation of the traditional but rather out of date method of gas accounting.

With regard to the lower quality gases, it is quite true that this formula will show a higher value of performance, but the difference between the higher and lower values is considerably reduced; also the enhancement of the imaginary value is greater for the higher qualities. For example: Compare a typical gas of 500 B.Th.U. with gases of 400 B.Th.U. and 200 B.Th.U.

Calorific value	500	400	200
Therms of gas per ton of coal...	75	115	200
Coke per ton of coal—cwt.	10	6	—
therms	140	84	—
Tar per ton of coal, therms	25	25	25
	165	109	25
Efficiency of gas-making from 300-therm coal, per cent.	25	38.3	66.7
Performance per standard ton—therms ...	167	181	218
per cent. ...	55.7	60.2	72.7

It is hoped that some further explanation will be given of the object of introducing this imaginary factor, which can only tend to cloud the issue as to the most satisfactory calorific value to produce. The criterion should be—"Which heating value is going to bring the greatest benefit to the consumer?" The introduction of this new factor is benefiting nobody.

GAS ENGINEERING ADVISORY BOARDS

By C. F. W. RENDLE

Mr. **J. Jamieson** (Edinburgh) wrote: I should like to express my appreciation, and I am sure the appreciation of all the other Chairmen and members of the Gas Engineering Advisory Boards, for the valuable pioneer work of Mr. Rendle and the Midland Advisory Board, and to say how much the experience gained and the procedure adopted by them has helped in framing the policy and line of action of the Boards in their main object, namely, the economical use of fuel in Gas-Works.

In the No. 11 (Scotland) Region, where there are 206 gas-works, of which 133 are under 50-mill. output, it has been necessary to appoint three Executive Committees so that the necessary work can be overtaken in a reasonable time, and these Committees are now at work

scrutinizing the returns which have been made and getting in touch with the various engineers.

That the Industry in Scotland is appreciative of the benefits that should accrue is indicated by the prompt return of 87 per cent. of the questionnaires sent out, representing 98 per cent. of the total gas supplied.

Preliminary calculations show that the average fuel expenditure index so far calculated for Scotland is in the region of 31 when using the standard calorific values laid down. Tabulation of the indices in accordance with the size of Works shows that the average index varies with the size of Works. The following table shows the grouping, average index and the lowest and highest in each group.

Annual make, mill.cu.ft.	No. of works.	Fuel efficiency index.		
		Average.	Lowest.	Highest.
Under 10	16	51	32	82
10–25	38	49	28	77
25–50	30	43	24	73
50–100	25	43	26	58
100–200	16	38	27	63
200–400	14	33	23	41
400–1,000	9	31	24	40
Over 1,000	7	27	23	44
	155	31	23	82

These figures, it should be stressed, are preliminary only and are based on the returns sent in, which show, in some cases, approximate figures for calorific value, &c. The Executive Committees are now at work investigating and confirming the figures, and exploring the apparently large differences in efficiency in similar-sized undertakings.

The average index figure of 31 for Scotland appears high, but when re-calculated to the actual calorific value of Scottish coals a decrease of 4 or 5 points is effected, thus bringing it into line with the average figures of 26 for the whole of the country. It is proposed meantime to retain the standard values, as it is realized that the primary object is to show improvement on the figures for the basic years.

The common causes of inefficient carbonization, as listed by the Author, are undoubtedly too prevalent, and the principal reasons are, also, the lack of trained and efficient technical and of chemical supervision. Remedial measures can only come from facilities provided regionally, particularly in regions where small Works predominate, and where these measures can be provided and suggested alterations in practice put into effect the results will show that the expenditure is fully justified. Among the difficulties not listed is the problem of providing and maintaining an adequate and efficient labour force. Small Works seem to have lost, through various causes, too large a proportion of their trained labour and the substitutes available are often unsuitable. Serious consideration will require to be given to this problem, as the efficiency in these Works depends so largely on the hour-by-hour attention to all working details.

I agree with the Author that the establishment of the Gas Engineering Advisory Boards is one of the most important steps taken by the Industry in recent years, and I have no doubt that the results as they accrue will, through the co-operation of all, fully justify their inauguration and continuance for the benefit of our Industry.

Mr. **F. H. Bate** (Birmingham) wrote: The measure of the success of the Midland Advisory Board may be judged from the fact that whereas there were several breakdowns in the winter of 1941/42, there was not one in 1942/43. Again, at this time last year 18 per cent. of the Undertakings were considered to be in a critical position in regard to satisfying the outputs for the winter of 1942/43, but as a result of the efforts that were made the outputs were met without serious difficulty.

The future activities must be concerned primarily with efficiency of production. I should like to plead for more extensive and accurate data, as it is impossible to assess efficiencies unless reliable figures for, say, water in coke and tar are supplied. It is hoped that the mobile laboratories will eventually determine such figures in No. 9 Region, but until such evidence is available it would appear to be desirable to adopt some method, such as that suggested by Mr. Dixon in his Paper at this Meeting, that would give prominence to the therms produced as gas. I should like to support the suggestion that gaseous therms should be expressed as a function of the difference between the total of the solid and liquid fuel received by the Works and the total of the solid and liquid fuel returned to the community. For our immediate domestic purposes I consider the objective should be a simple figure for gaseous heat, and not a figure swollen by errors through including water in coke and tar, &c.

The Author has referred to the documentary evidence that has been collected by the Midland Board. It would be premature to attempt to draw any hard and fast conclusions, but it is clear that efficiency is not in direct proportion to size. The fundamentals seem to be a carbonizing plant designed to produce the declared calorific value and the full use of any waste heat. Further, the plant must be so arranged that the seasonal outputs can be economically balanced against the constituent units of the plant. It is remarkable how some comparatively small Undertakings, fulfilling these conditions, have achieved good efficiencies. It is also clear that in many instances the value of the savings that can be effected far outweigh the cost of any technical services such as the Chemical Facilities Scheme.

Mr. **T. C. Battersby** (Watford) wrote: The thanks of the Industry are due to the Midland gas engineers for having created the first organization designed specifically to render practical assistance and to give specialized advice to Undertakings struggling under the additional strains imposed by the war, and to Dr. Smith, who, when Director-General of Gas Supply, was so quick to appreciate the benefits which would accrue both to the nation and the Gas Industry by the extension of such panels throughout the country.

I think it may be said that through the activities of the Gas Engineering Advisory Boards we have all become more efficiency-conscious, and whilst this is the pre-requisite of any general improvement, it is perhaps natural to ask whether the recommendations of these Boards will be implemented. In my opinion generally "yes"—but how quickly will to a great extent depend upon the circumstances and the imminence of the besetting difficulties. How often are we all implored to arrange for periodical medical examinations, but few take such precautions and the majority struggle along, reluctant to seek medical assistance until the symptoms become chronic!

The Author is to be congratulated on the courage he has shown in enumerating some of the various causes which have culminated in breakdowns and failures, and I have no doubt the investigations carried out by other Regional Boards reveal similar weaknesses. If some Companies have escaped disaster it is because they have not been called upon to bear increased loads like those imposed upon Undertakings in the Midland Region. I am not convinced that these sources of trouble all arise from apathy, or the failure of engineers to appreciate the fundamental requirements of good management. It would appear that some engineers are restrained by their directors or committees, and enterprise is discouraged through a mistaken conception of their responsibilities and obligations.

I am sure that many engineers are taxed almost to the limits of their physical endurance, and we who are employed by the larger Undertakings should regard ourselves fortunate that we are not required to bear the burdens under which the engineers of the small Undertakings labour. Often on Works making up to 100 mill. cu.ft. per annum the manager has no technical assistance, and his duties embrace secretarial work, commercial management, the interviewing of consumers, even the payment of weekly wages and the making of such chemical tests as he finds himself able to perform. How can they give the attention to details which modern standards of efficiency demand? In pre-war days some of the larger Works had insufficient technical supervision, and the demands of the services have seriously depleted their staffs.

These are difficulties which by mutual aid and the pooling of resources the Advisory Boards hope to overcome. The limitations of the Industry's present structure impose a heavy task upon the Boards, but they are anxious to gain the confidence of the Undertakings, assist them with their immediate problems, and establish the importance of adequate technical control. The Boards have been in existence only a very short time; their potential value is enormous, but ultimate success will depend upon the care with which the foundations are laid.

It is first essential to have a complete picture of the conditions obtaining in each undertaking within the region. No simple "yardstick" can be used to measure performance, and without due regard to local conditions it is both dangerous and misleading to make direct comparisons based on the Fuel Index Figure. We thus have recourse to questionnaires. In the Eastern Region, the interest these have aroused and the courtesy shown to members of the Board when they have had occasion to visit an Undertaking leads me to believe that our efforts will not be in vain, but naturally progress will be slow where increased efficiency only, and not the imminence of a breakdown, is the compelling force.

In common with the Author's experience in the Midlands, investigations carried out in the Eastern Region show that integration is imperative if the Gas Industry is to retain its present business and expand its services. Though fuel conservation is everyone's immediate concern, the ultimate objective of the Boards will be attained only when every consumer in the country enjoys the best service the Industry is capable of providing under the existing structure.

Mr. **C. M. D. Belton** (Shrewsbury) wrote: The investigations which have been carried out by the Midland Board reveal that the measure of production efficiency achieved is not necessarily directly proportional to the size of the Gas Undertaking, although manifestly in the smallest Works, where control is vested in one person alone, it is impossible for him to find time, capable though he may be, to exercise the technical control of production and supply in addition to his other varied responsibilities. The process of integration of the Industry must perforce cover a considerable period of time. Meanwhile a most useful and necessary function can be performed by the Advisory Boards, especially if they can institute a mobile laboratory whereby expert examinations may be conducted periodically at the various Works visited, and useful suggestions made for securing improved results. Experience has shown that, so far from resenting the work of visiting technicians, managers have welcomed the opportunities for consultation so afforded. Where financial considerations have precluded the purchase of scientific apparatus a mobile laboratory is particularly welcome; but even where the Works are well equipped a fresh approach to current problems by visiting experts has assisted in finding satisfactory solutions to many of the difficulties encountered. The gas engineer who is proud of his profession naturally aims at combining an economic perfection of production with satisfactory service to consumers. The attainment of these ideals can only be

achieved by careful management and long-sighted planning, but in this the engineer has been sometimes frustrated owing to the parochial and short-sighted policy adopted by his Committee or Board, or through difficulty in raising the necessary funds.

Now that it is becoming recognized, at long last, that the Gas Industry forms an important part of the national economy, it is essential that a progressive policy should be adopted by every Undertaking or Group. The ideal to be aimed at is what may be termed a "straight line service," comprising constant calorific value, constant composition, and constant pressure for every consumer. In this connexion the tolerances that have been published are quite liberal, and it should be possible for most Undertakings to work well within those limits. It is no less important that the quality of our residuals or by-products should be maintained at an acceptable standard, as only by this means can those valuable markets be depended upon to give us the return which will enable gas to be sold at a reasonable price.

It is to be hoped that the Ministry of Fuel and Power will adopted a more benevolent rather than censorious attitude towards the legitimate aspirations of the Gas Industry generally, and also develop some method of dealing more expeditiously and generously with the applications of individual Undertakings for sanction to proceed with urgent and necessary improvements and extensions, especially when sponsored by the Gas Engineering Advisory Boards.

Mr. **E. L. Nicholas** (Guildford) wrote: The Midland Panel was particularly fortunate in that it was founded on mutual agreement as a measure of self-help and mutual aid. It set itself the tremendous task of assessing the potentialities of every Gas Undertaking in its area and, by so doing, acquired a store of valuable information, and at the same time inspired confidence among the Undertakings it set out to assess. Its success has been recognized by the Ministry of Fuel and Power, which has used it as a model for the Regional Gas Engineering Advisory Boards which were set up at the end of last year.

It seems to me, however, that the newly-created Boards have of necessity worked on somewhat different terms of reference from those of the Midland Advisory Panel. Since their formation, these Boards have been mainly concerned with an enquiry into the use of fuel and the calculation of an index figure for each Undertaking, intended to show on a uniform basis the efficiency or otherwise of the Undertaking in terms of its fuel output-intake ratio.

Now I do not want to suggest that this work is not useful; it undoubtedly is. Every one of us appreciates that the utmost economy in the use of fuel is vital to the nation, and the improvements already noticeable in fuel expenditure figures prove that time is not being wasted, though it should be said here that these improvements have been obtained not so much as the result of what the Boards have done —they have been in existence for too short a time to have produced real results—but merely as a result of the emphasis which the enquiries in progress have laid upon fuel economy and the resultant efforts of the Undertakings themselves.

I am a little doubtful of the wisdom of comparative figures. Between one Undertaking and another and between one Region and another there must of necessity be wide variations in plant, labour and other conditions that make comparison almost impossible. If we can achieve a progressive improvement at each Works (and our experience points to that already) without too much emphasis on what I might call the competitive spirit, we shall have accomplished something worth while.

Region No. 12 is perhaps unique in that it comprises two distinct zones—what used to be called evacuation and reception areas. On the south and easterly boundaries are the Undertakings situated chiefly in coastal towns, often with considerably reduced outputs—carrying on under almost unbelievable difficulties—but still carrying on. To the north and west lie the Undertakings that have had to meet phenomenal increases in demand due to movement of population and industry. How can one lay down any standards under such widely different circumstances in one region alone?

The Gas Engineering Advisory Boards have grown out of the Midland Advisory Panel—a group of engineers who got together to form a body willing and able to give advice or assistance to any engineer in the Midland Region who might require it. It was, and is, a mutual aid scheme, and that is what, in my opinion, the Regional Advisory Boards ought to be. In concentrating, as we have had to do, on fuel economy, our introduction to the Undertakings in our regions has had to be by means of enquiries and questionnaires, which of course are never popular, and in many instances it has been necessary to arrange for a member of the Board to visit the Undertaking. However tactful the approach, it is always possible that the engineer whose Works are visited in these circumstances may consider it a reproach on his management. In this respect I should say at once that in No. 12 Region so far we have found nothing but eagerness to co-operate and that there is no reason why any friction should exist, but I do feel that the Regional Gas Engineering Advisory Boards would be of greater service to the Industry if their terms of reference could be brought more into line with the idea lying behind the formation of the Midland Advisory Panel which Mr. Rendle has so ably described in his Paper.

THE PROBLEM OF CALORIFIC VALUE

By J. E. DAVIS

Mr. **A. J. Leather** (Blackburn) wrote: The Author makes a valiant attempt to analyse the many factors concerned with calorific value, particularly with regard to production and distribution, but the results are disappointing and hardly a reliable guide to actual practice. It is significant, however, that the results tend to support a lower calorific value than is general at present, but it is doubtful whether sufficient recognition has been given to the advantages appertaining to the lower qualities, especially below 350 B.Th.U. The large savings in both capital and maintenance resulting from the greatly simplified apparatus required for total gasification and the absence of hard-wearing coke-handling plant seem to have been overlooked. With regard to distribution it is apparently assumed that present mains and services are working to full capacity, but for the most part this is not so, and a slight increase of pressure at the Works combined with efficient governing at the point of use should go a long way towards relieving heavy charges on larger mains.

There is one factor which so far seems to have received scant consideration, however, and that is the factor of utilization. Is one quality of gas more costly to use than another? I am not referring to the price charged for gas but to the value obtained from the money spent. If our criterion is going to be the benefit to the consumer, this question must be faced. The performance of any given operation, —*e.g.*, boiling one quart of water—requires a specific number of heating units. The time within which the operation can be completed depends on the number of heat units liberated by the gas in unit time. It may be argued that this is solely a matter of volume, but there is a definite limit to the amount of gas that can be burned in a given space without lowering the thermal efficiency of the operation and thereby increasing the cost for gas.

It would appear, therefore, that the solution lies in adopting means to increase the temperature of the flame, thereby liberating a greater number of heat units in a given space. In industrial practice one of the methods used to achieve this end is to increase the pressure of the gas very considerably. The effect of this is to increase the quantity of air entrained for combustion, thereby raising the flame-speed of the mixture and obtaining more intense combustion. Can this condition be approached without resort to mechanical pressure? That is to say, by what means can the air-gas ratio of the gas and air mixture be made to approach nearer the theoretical proportion required, while safeguarding at the same time the possibility of blow-back, so that the flame is not diluted by extraneous air and the maximum flame temperature thereby reduced. It is contended that this problem is one of calorific value, and should receive consideration when the question of the most suitable value is under discussion.

As the flame temperature of any gas is very largely dependent on obtaining an ideal gas and air mixture the problem is one of air entrainment. It is not easy to calculate the quantity of air that may be entrained under a given set of circumstances, but the amount is related to the momentum of the gas issuing from the jet, and can be expressed approximately as:

Volume of air entrained $= cM^x$, where M is the momentum of the gas at the jet and the factors c and x depend on burner conditions, such as shape of throat, design and area of ports, etc., as well as the units in which the momentum is expressed. I have recently studied the characteristics of a number of gases of different heating value* and this formula has been applied to the figures obtained, taking c as 64 and x as 0.5. It is contended that the actual air entrained expressed as a percentage of the theoretical amount required is a measure of the efficiency of utilization of the gas concerned. It is apparent, of course, that the lower quality gases are considerably favoured in this respect.

Any gas which enables a consumer to perform a given operation in less time for the expenditure of the same energy is not only of great benefit to the consumer, but should be a very definite asset to the supplier of the gas concerned. It may be difficult to assess this factor on the lines laid down in Mr. Davis's Paper, but it is all part of the problem of calorific value. Mr. Davis may feel that this is outside his terms of reference; if so, I hope that it may receive due consideration in some other quarter, because the determination of the heating value that it is to be of greatest benefit to the user is a question of prior importance.

* "The Place of Heating Value in Gas Utilization." Paper read before the Manchester and District Junior Gas Association, February 27, 1943.

(*To be continued*)

Mr. R. Wilson Bartlett, J.P., Deputy Chairman of the Newport Gas Company, presided at the annual allotments, gardens, produce, and flower competitions at Crindau, Newport.

Messrs. Wilsons and Mathiesons, Ltd. (Radiation Ltd.), are numbered among the Radiation Companies who have earned a "Certificate of Honour" which has been awarded to their Savings Group in connexion with the recent "Wings for Victory" week in Leeds.

The Directors of South-Eastern Gas Corporation, Ltd., have declared an interim dividend on the Ordinary Stock of 1½%, less tax.

GAS PRODUCTS PRICES—STOCKS AND SHARES

The London Market Aug. 23.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

A new Order entitled The Control of Toluene (No. 3) Order, 1943 (S. R. & O. 1943, No. 976), came into force on July 20, and introduces certain changes in the prices for different grades of Toluene.

There are no changes to report in the prices of Coal Tar Products.

The Provinces Aug. 23.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 11d., pure, 2s. 7½d. (controlled by the Control of Toluene No. 3 Order, 1943, dated July 14, operative from July 20, 1943). Naphtha and Xylole controlled by the Coal Tar Naphtha and Xylole Order, 1943, dated May 31 (S. R. & O., 1943, No. 768), operative from June 1. Carbolic acid, 60's, naphthalene, and anthracene controlled by the Coal Tar Products Prices Order S. R. & O. 2509, dated Dec. 7, 1942, and operative from Jan. 1, 1943. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4½d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Aug. 21.

Export business is increasing. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil 6¾d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5¾d. per gallon; all *ex* Works in bulk. Refined cresylic acid is being shipped to U.S.A. at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha: 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/180 grade 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

The volume of business in the Gas Market was on a smaller scale last week, but prices continued well maintained and several "Ordinaries" made small improvements, a feature being the gain of 1s. 6d. in Gas Consolidation "A" Stock. Gas Light units on the other hand closed 3d. down at 19s. 6d.

There is a fairly long list of Gas debenture stocks available, and although the parcels are small, the inclusion of a few of these holdings in any list of investments, having regard to the security offered, should be profitable. Among these are the following, the yields being shown in brackets:

£200 British 4% Hull at par; £772 Commercial 5% at 113 (£4 8s.); £1,500 Gas Light 4½% at 109 (£3 15s. after allowing for redemption); £280 Northampton 4% at 105 (£3 16s.); £500 South Suburban 4% at 105 (£3 16s.); while £600 Tunbridge Wells 4½% at 112 and £1,655 Wellington (Salop) 5% at 125 both yield 4%.

The following price changes were recorded during the week:

PROVINCIAL EXCHANGES

Great Grimsby "A" (*x.d.*)	160—170	Aug. 9
" " "B" (*x.d.*)	160—170	"
" " "C" (*x.d.*)	150—160	"
" " Ord. (*x.d.*)	14—18	"
Liverpool Ord.	107½—108½	+1½
Preston "A" (*x.d.*)	167—169	Aug. 9
" "B" (*x.d.*)	124—129	"
Weston-Super-Mare Ord. (*x.d.*) ...	105—107	"

OFFICIAL LIST

Barnet Ord. (*x.d.*)	153—158	Aug. 16
Bombay	23/—25/-	+-/6d.
Bournemouth max. Div. (*x.d.*) ...	148—153	Aug. 16
Commercial Ord.	70—75	+1
Gas Light & Coke Units	19/—20/-	--/3d.
Ditto 3½ p.c. max.	77—81	-½
Portsmouth Cons. (*x.d.*)	120—125	Aug. 16
Severn Valley Ord.	21/—22/-	+-/6d.
South Metropolitan 6 p.c. Pref. (*x.d.*)	126—131	Aug. 16
Ditto 4 p.c. Pref. (*x.d.*)	90—95	"
Southampton Ord. (*x.d.*)	92—97	"
Swansea 5½ p.c. Pref. (*x.d.*)	95—100	"
Tottenham	108—113	+2
Uxbridge Ord. (*x.d.*)	118—123	Aug. 16

SUPPLEMENTARY LIST.

Cheltenham Ord. (*x.d.*)	97—102	Aug. 16
Gas Consolidation "A" Ord. ...	18/—20/-	+1/6d.
Hampton Court Cons. (*x.d.*) ...	95—100	Aug. 16
North Middlesex 5 p.c. Pref. (*x.d.*)	105—110	"
Tunbridge Wells Sliding Scale (*x.d.*)	118—123	"

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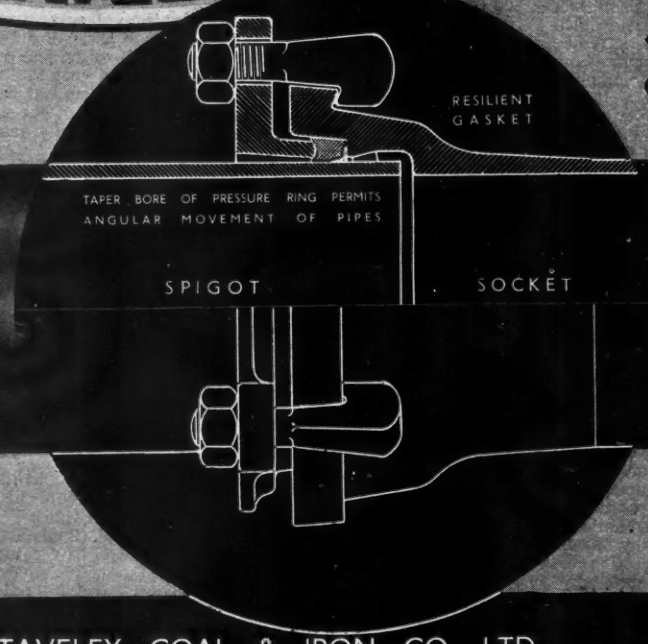

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